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Knowledge of hypoglycemia and its associated risk factors among type 2 diabetes Mellitus patients in diabetes Centre, Security Forces Hospital, Riyadh, Saudi Arabia

Author
Naif Mohammed Albaqami
Family Medicine Resident

Abstract

Background: *Hypoglycemia is the most common and serious side effect of glucose-lowering medications and considered the rate-limiting side effect in achieving tight glycemic control in Diabetes Mellitus (DM). Diabetes-related hypoglycemia has both short-term and long-term complications. Moreover, hypoglycemia episodes, especially the severe ones, lead to a considerable increase in both direct and indirect medical care costs*

Objectives: *Primary objective: Study the knowledge about hypoglycemia among type 2 diabetic patients attending the diabetes centre clinics, F & CM Department at SFH, Riyadh.*

Secondary objectives: To assess the most common causes, symptoms and prevalence of hypoglycemia among type 2 diabetes patients in SFH.

Methods: *Cross-sectional study among Type 2 diabetic patients visiting the diabetes centre clinics at SFH in 2017*

Results: *Of 386 participants, 237 participants (61.4%) had good knowledge of hypoglycemia, but only 149 participants (38.6%) had poor knowledge. The mean age, weight and height of participants were 53.7±13.5 years, 80±27.2 Kg and 158± 21 cm. According to participants' opinion about the most common cause of hypoglycemia is exertion (68.7%) and most common symptom of hypoglycemia is dizziness (74.6%).239 (61.9%) experienced a hypoglycemic event in the last three months; and, the majority of them, 126 (52.7%) had less than three times attacks of hypoglycemia, and only 107 (27.7%) had no previous hypoglycemia in the last three months.*

Conclusion: *Participants had good knowledge about hypoglycemia and its preventive method. However, increasing incidence of hypoglycemic events needs more diabetes education programs to apply their knowledge on a daily routine.*

Keywords: *Diabetes, hypoglycemia, type 2, symptoms, prevalence.*

Introduction

Hypoglycemia has been defined by both the American Diabetes Association (ADA) and the European Medicines Agency as “any abnormally low plasma glucose concentration that exposes the subject to potential harm” with a proposed threshold plasma glucose value <70 mg/dL (<3.9 mmol/L)[1,2]. Hypoglycemia, a frequently underestimated problem, is the most common and serious side effect of glucose-lowering medications and considered the rate-limiting side effect in achieving tight glycemic control in

Diabetes Mellitus (DM). Repeated hypoglycemic episodes can adversely affect the counter-regulatory system resulting in significant morbidity and mortality which is reportedly associated with a six-fold increase in death[3,4]. Diabetes-related hypoglycemia has both short-term and long-term complications including cerebrovascular disease, cardiovascular diseases, retinal cell death, vision loss, and neurocognitive dysfunction in addition to health-related quality of life issues[5]. Moreover, hypoglycemia episodes, especially the severe ones, lead to a considerable increase in both direct and indirect medical care costs [6,7].

Evidence from previous observational studies indicates that hypoglycemia risk is particularly high among patients who are on insulin treatment [8-10], and have a longer diabetes duration and longer duration of insulin treatment[8]. Although occurring more frequently in type 1 diabetes, hypoglycemia also is clinically important in type 2 diabetes. In regards to hypoglycemia among type 2DM, it has been previously reported that hypoglycemia requiring emergency assistance from health service personnel is as frequent in insulin-treated type 2 diabetes people as in type 1 diabetes people[9]. Prevalence and incidence of hypoglycemia were high among insulin-treated patients with diabetes in Canada, and some patients took harmful or costly actions when they experienced hypoglycemia[11], another study done in UK on 2003 concluded the prevalence of severe hypoglycemia was 7.3% in patients with T2DM treated with insulin, and 0.8% in patients with T2DM treated with sulfonylurea[9]. Similarly, a previous study in Denmark among type 2 DM indicated that there was at least one episode of severe hypoglycemia in 16.5% of patients with an incidence of 44 episodes/100 patient years[10].

Generally, hypoglycemia in DM patients occurs when there is an imbalance between insulin/hypoglycemic agent's intake and the body's physiological need. The reasons that could account for hypoglycemia in diabetic patients are Iatrogenic, Diet changes and infections[18].

Literature Review

This systematic literature investigated Knowledge of hypoglycemia and its associated risk factors among type 2 diabetes Mellitus patients in diabetes Centre in the kingdom of Saudi Arabia. Searches were done by reviewing journals and articles found in PubMed database. Several articles that were not accessible by full text from the databases were obtained using Google Scholar. Based on the results of Kedia N study[20], overall, the most common identified cause of severe hypoglycemia among type 2 diabetic patients were: insufficient food consumption (47% in T2DM), followed by physical exercise (23%), insulin dose miscalculation (16%), stressful situations (17%), oscillating blood glucose levels (8%) and impaired hypoglycemia awareness (5%) T2DM[20]

In India, study included 366 type 2 diabetic patients, 242 (66.1%) diabetic patients had good knowledge on hypoglycemia (knowledge of at least three symptoms of hypoglycemia together with at least one precipitating factor and at least one remedial measure[22]

In Arar, Saudi Arabia, a study conducted to to assess the awareness of the Arar population with various aspects of diabetes mellitus., the study results in out of 702 participants The majority (86.3) of the participants believed that the treatment of DM was a combination of healthy diet, exercise and medication and more than half (63.1%) said that weight loss and modification of life style were the most important preventive measures of DM. Regarding participants' knowledge about DM complications, 24.5% knew about retinopathy and loss of vision, 8.3% knew about retinopathy, loss of vision, low sensation and numbness in extremities, 24.9% said that symptoms of DM were thirst and frequent urination[23]

The Kingdom of Saudi Arabia ranked to be the seventh among the top ten countries with high diabetes prevalence[24].

Patients & Methods

Study design and duration

Cross-sectional study, from 1st May 2017 –1st of November 2017

Results

Patient baseline characteristics

Out of 386 participants, the mean age, weight and height of participants were 53.7±13.5 years, 80±27.2 Kg and 158± 21 cm, respectively. This section in our questionnaire was designed to assess the socio-demographic features of our participants. It involved 10 questions which were answered by participants. Responses to each question were listed in Table (1). The data was expressed as (frequency and percent). Male participants 257 (66.6%) were higher than female 129 (33.4%). Most participants aged between 51-60 years 122 (31.6%). Obesity was high among participants 238 (61.4%). Most of our participants had diabetes less than five years ago 177 (45.7%).

Table 1 socio-demographic feature of participants among type 2 diabetes Mellitus patients in diabetes Centre, Security Forces Hospital, Riyadh, Saudi Arabia

	No	%
Age*		
20-30	52	13.6
31-40	51	13.3
41-50	55	14.2
51-60	122	31.4
>60	106	27.5
BMI*		
Normal weight	84	21.9
Overweight	64	16.7
Obese	238	61.4
Gender		
Male	257	66.6
Female	129	33.4
Marital status*		
Single	62	15.9
Married	255	65.8
Divorced	39	7.7
Widowed	40	10.6
Job title*		
Student	50	12.9
Civilian job	75	19.5
Military officer	74	19.2
Military field	103	26.7
Retried	65	16.7
Unemployed	19	5
Education level		
Illiterate	139	35.9
Primary/secondary	74	19.3
University	108	28
Post graduate	65	16.8
Socioeconomic level* (SAR)		
<5000	150	38.5
5000-10000	53	13.8
10000-15000	139	33.5
>15000	54	14.2
Diabetes duration		
<5	177	45.7
5-10	82	21.3
>10	127	33
Diabetes treatment*		
Diet	83	21.5
Oral	117	30.3
Insulin	95	24.7
Oral and insulin	91	23.5

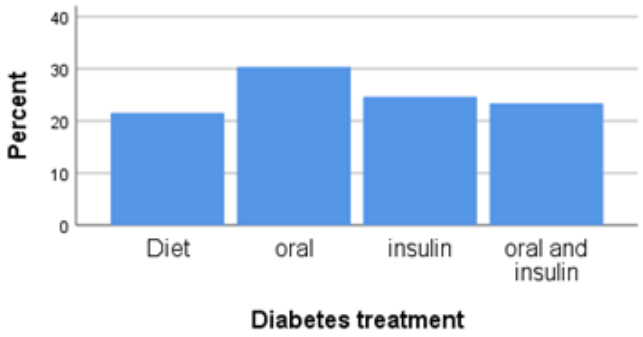

Figure 1 diabetes treatment regimen among type 2 diabetes Mellitus patients in diabetes Centre, Security Forces Hospital, Riyadh, Saudi Arabia.

Table 2 prevalence and frequency of hypoglycemia events among type 2 diabetes Mellitus patients in diabetes Centre, Security Forces Hospital, Riyadh, Saudi Arabia

	No	%
Hypoglycemia event in the last 3 months (out of 386 patients)		
Yes	239	61.9
No	107	27.8
Don't know	40	10.3
Hypoglycemia frequency (out of 239 patients)		
<3	126	52.7
3-6	75	31.3
>6	38	16

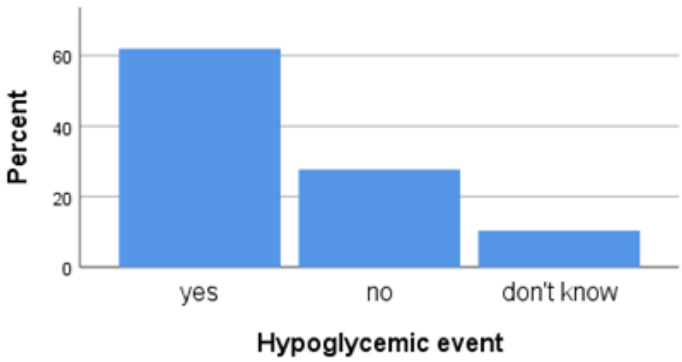

Table 3 Knowledge of symptoms of hypoglycemia among type 2 diabetes Mellitus patients in diabetes Centre, Security Forces Hospital, Riyadh, Saudi Arabia

	No	%
Dizziness		
Yes	288	**74.6**
No	57	14.8
Don't know	41	10.6
Drowsiness		
Yes	183	47.4
No	129	33.4
Don't know	74	19.2
Excessive hunger		
Yes	282	**73.1**
No	56	14.5
Don't know	48	12.4
Sweating		
Yes	277	**71.8**
No	62	16
Don't know	47	12.2
Tremor		
Yes	275	**71.2**
No	52	13.5
Don't know	59	15.3
Palpitation		
Yes	250	**64.8**
No	76	19.7
Don't know	60	15.5
Shaking		
Yes	230	59.6
No	76	19.7
Don't know	80	20.7
Prickly skin		
Yes	160	41.5
No	160	41.5
Don't know	66	17
Headache		
Yes	186	48.2
No	133	34.5
Don't know	67	17.3
Weakness		
Yes	180	46.7
No	140	36.3
Don't know	66	17
Loss of consciousness		
Yes	178	46.1
No	153	39.6
Don't know	55	14.3
Confusion		
Yes	225	58.3
No	96	24.9
Don't know	65	16.8
Irritability		
Yes	167	43.3
No	147	38
Don't know	72	18.7
Blurred vision		
Yes	214	55.4
No	102	26.4
Don't know	70	18.2
Aggression		
Yes	154	39.9
No	153	39.6
Don't know	79	20.5
Slurred speech		
Yes	187	48.4
No	121	31.4
Don't know	78	20.2

Table 4 Knowledge of precipitating factor of hypoglycemia among type 2 diabetes Mellitus patients in diabetes Centre, Security Forces Hospital, Riyadh, Saudi Arabia

	No	%
Missing or delaying food		
Yes	262	67.9
No	79	20.5
Don't know	45	11.6
Exertion		
Yes	265	**68.7**
No	68	17.6
Don't know	53	13.7
Wrong Dose		
Yes	216	56
No	97	25.1
Don't know	73	18.9
Alcohol ingestion		
Yes	135	35
No	109	28.2
Don't know	142	36.8

Table 5 Knowledge of complications of hypoglycemia among type 2 diabetes Mellitus patients in diabetes Centre, Security Forces Hospital, Riyadh, Saudi Arabia

	No	%
Paralytic attack		
Yes	109	28.3
No	129	33.4
Don't know	148	38.3
Heart attack		
Yes	116	30
No	160	41.5
Don't know	110	28.5
Coma		
Yes	161	41.7
No	122	31.6
Don't know	103	26.7
Fits		
Yes	141	36.5
No	144	37.3
Don't know	101	26.2
Death		
Yes	179	**46.2**
No	80	20.6
Don't know	129	33.2

Knowledge of action taken during an attack of hypoglycemia

Table 6 Knowledge of action taken during the attack of hypoglycemia among type 2 diabetes Mellitus patients in diabetes Centre, Security Forces Hospital, Riyadh, Saudi Arabia

	No	%
Eat sweets/ chocolates/ biscuits		
Yes	222	57.5
No	80	20.7
Don't know	84	21.8
Eat food		
Yes	213	55.2
No	99	25.6
Don't know	74	19.2
Drink glucose*		
Yes	182	48
No	99	25.6
Don't know	98	25.4
Drink sugar syrup/ juices/ milk		
Yes	230	**59.6**
No	89	23
Don't know	67	17.4
Use glucagon injection		
Yes	208	53.9
No	74	19.2
Don't know	104	26.9

*7subjects with missing data

Knowledge of prevention from hypoglycemia

Table 7 Knowledge of prevention from hypoglycemia among type 2 diabetes Mellitus patients in diabetes Centre, Security Forces Hospital, Riyadh, Saudi Arabia

	No	%
Take timely meals		
Yes	270	69.9
No	44	11.4
Don't know	72	18.7
Take medication as advised by the doctor		
Yes	274	71
No	65	16.8
Don't know	47	12.2
Report low sugar episode to the doctor to adjust the medications*		
Yes	268	74.1
No	38	9.8
Don't know	62	16.1
Self-monitoring of blood sugars		
Yes	288	**74.6**
No	46	11.9
Don't know	52	13.5

*3 with missing dat

Table 8 source of Knowledge about hypoglycemia among type 2 diabetes Mellitus patients in diabetes Centre, Security Forces Hospital, Riyadh, Saudi Arabia

	No	%
1	148	**38.4**
2	24	6.2
4	60	**15.5**
5	6	1.6
6	13	3.4
8	6	1.6
1 2	6	1.6
1 2 4	6	1.6
1 2 4 6	7	1.8
1 3 5	7	1.8
1 4	31	**8**
1 4 5	7	1.8
1 4 5 6	6	1.6
1 5	13	3.4
1 7	7	1.8
1 8	6	1.6
4 5	12	3.1
4 8	7	1.8
5 6	14	3.6
Total	386	100

1 doctor, 2 fellow patient,3 relative,4 TV/radio,5 magazine,6 diabetes educator,7 nurse/paramedics,8 hospital charts/boards

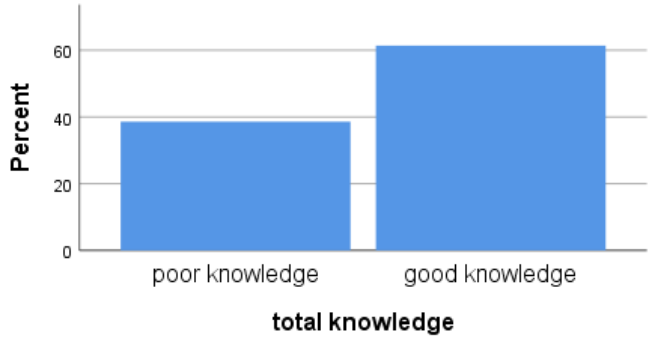

Figure 3 Composite score for knowledge about diabetes among type 2 diabetes Mellitus patients in diabetes Centre, Security Forces Hospital, Riyadh, Saudi Arabia.

Discussion

In this study, we concern about hypoglycemia in type 2 diabetic patient as it is one of the most important complications of diabetes treatment. Episodes hypoglycemia may lead to impairment of counter-regulatory system, with the potential of development of hypoglycemia unawareness. So, hypoglycemia may increase the vascular events even death in addition to other possible detrimental effects. The significant finding in our results is that there was an adequate total knowledge 61.4% (273/386) of diabetes regarding symptoms, precipitating factors, complications, action taken during attacks and methods of prevention. Another study conducted in a primary care centre in eastern Saudi Arabia to assess Knowledge of diabetes risk factors and preventive measures among attendees 121 participants (42.0%) had knowledge of DM risk factors and 120 (41.7%) had knowledge of DM prevention [25].

Despite the fact that the cause of DM is unknown, many of its modifiable lifestyle-related risk factors have been identified and studied. The most common known cause of hypoglycemia was exertion (68.7%) followed by missing or delaying food (67.9%). These results in accordance to The accumulating evidence suggests that DM is a potentially preventable disease if its risk factors are identified early and avoided[26-29] Lifestyle interventions (e.g. physical activity, weight loss) have proven to be more effective than medicine in preventing or delaying the onset of DM in persons at high risk of developing the disease.

Our results showed that dizziness is the most common cause of hypoglycemia (74.6%) between diabetic patients followed by excessive hunger (73.1%), sweating (71.8%) and tremor (71.2%).n associated cause was reported by 147 (57.0%) of 258 patients who reported hypoglycemia. Retrospective, cross-sectional analysis set in an outpatient specialty diabetes clinic assumed that the most common event associated with hypoglycemia was a missed meal (119 patients [80.9%]), followed by use of medications in doses higher than those prescribed (8 patients [5.4%]), exercise (5 patients [3.4%]), and other (12 patients [8.2%])[30].

In general, the frequency of hypoglycemia is lower in people with type 2 diabetes than Type 1 [31]. However the prevalence of type 2 diabetes is about twenty-fold higher than type 1 diabetes, and many patients with type2 diabetes finally require treatment with insulin; therefore most episodes of hypoglycemia occur in patients with type 2 diabetes. Our results show a high incidence of hypoglycemia (61.9%) with less than three times frequency (70.6%) over the last three months prior to the initiation of the study. However, patients in the insulin-treated groups had a higher prevalence of hypoglycemia than patients in the diet-only group (30.5% [193/633] vs 11.8% [9/76]; P<.001), and patients treated with a combination of insulin, metformin, and sulfonylurea (triple therapy) had a 2-fold increase in any hypoglycemia compared with other patients treated with insulin (61.5% [8/13] vs 29.8% [185/620]; P = .01)[32].

Severe hypoglycemia has a considerable impact on wellbeing, productivity and quality of life in old people with diabetes [33]. Hypoglycemia can lead to many complications especially in elderly people[13]. Most common complications known by our participants are fits (37.1%) and death (47.1%).

Doctors (38.4%) are the most common source of knowledge in participants' answers. Television and radio is the second source of information represented (15.5%). Healthcare providers were the preferred source of information on driving and diabetes for 78% of drivers[31]. Nearly two-thirds of family members and friends actively sought information about hypoglycemia, while health professionals and print media were reported as the main sources[35].

Limitations of our study include its cross-sectional design, which prevents an exact calculation of incidence of hypoglycemia and therefore prohibits direct comparison of the results of our study with other study designs. In addition, the data rely on patients' abilities to remember and interpret symptoms as a consequence of low blood glucose levels. Consistent with earlier studies and routine practice, which rely on patient self-reports to make clinical decisions; our results reflect information that is clinically relevant and available to most practitioners. Another limitation may be that most of our participants are Saudi in Riyadh city. Although we do not know whether our results can be generalized to other populations.

Conclusion

Hypoglycemia can be an important limiting factor in the treatment of patients with type 2 diabetes. Despite slightly good knowledge among participants about hypoglycemia, they also had a high incidence of hypoglycemic events. Educational programmers are needed to encourage patients to apply their knowledge in practical life and to ensure the dangerous consequence of a low blood sugar level can be avoided.

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